

TITLE OF RESEARCH TASK: Infrared Measurements of Atmospheric Constituents

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ABSTRACT OF RESEARCH OBJECTIVES:

The objective of this program is to obtain data concerning the concentration versus altitude of various constituents of interest in the photochemistry of the stratospheric ozone layer. Data pertinent to this objective are obtained using balloon-borne instruments to measure the atmospheric transmission and emission in the mid infrared. In addition to obtaining constituent profile information, the spectral data obtained are also used to identify absorption or emission features which may interfere with the retrieval of constituent data from satellite instruments using lower spectral resolution.

SUMMARY OF PROGRESS AND RESULTS:

The primary instrumentation used on this program is a very high resolution ( $0.002\text{ cm}^{-1}$ ) interferometer system. This system is interfaced with a solar tracking system so that high resolution solar spectra can be obtained while the unit is flown on a balloon. In order to enhance the sensitivity of the system to the detection and measurement of trace constituents the flights are performed so as to obtain data during solar occultation. The system has been flown three times during the period covered by this report. The first flight was performed from Ft. Sumner, New Mexico on November 18, 1987. The second flight was launched from Palestine, Texas on June 6, 1988 and the third flight was flown from Ft. Sumner, New Mexico on April 19, 1989. All three flights were complete successes and solar spectral data were obtained covering the region from  $750$  to  $1925\text{ cm}^{-1}$  ( $5.2$  to  $13.3$  microns) at solar zenith angles from  $80^\circ$  to  $96^\circ$ .

The spectral resolution obtained with the solar spectral system is  $0.0025\text{ cm}^{-1}$  and represents about a factor of 5 greater resolution than any solar spectra previously obtained in this spectral region. As a result of the increase in spectral resolution a large number of features are observed in these spectra which were not observed in previous studies. Identification and analysis of these features is in progress. The results of this analysis to date shows a number of  $\text{HNO}_3$  features which have not been observed before, and these occur where they will interfere with the retrieval of other constituents. An example of the interference is the occurrence of features in the  $780.2\text{ cm}^{-1}$  region which overlap the  $\text{ClONO}_2$  feature which will be used for retrieval of  $\text{ClONO}_2$  by the CLAES instrument on UARS. A number of features due to  $\text{COF}_2$  have also identified in the  $1250\text{ cm}^{-1}$  region which may interfere with retrieval of  $\text{N}_2\text{O}_5$ .

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In addition to the flights performed with the solar spectral instrumentation, a flight was also performed with an atmospheric emission radiometer system. The instrument was flown from Kiruna, Sweden on January 23, 1989 as part of the European Arctic campaign. For this flight, optical filters were chosen which were centered on the  $\text{HNO}_3$  emission in the  $11\mu\text{m}$  region. This flight was also a success, and an  $\text{HNO}_3$  profile was obtained.

#### PUBLICATIONS:

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Goldman, A., R.D. Blatherwick, J.J. Kusters, F.J. Murcray, J. Van Allen, F.H. Murcray and D.G. Murcray, "Atlas of Very High Resolution Stratospheric IR Absorption Spectra; Preliminary Edition," Department of Physics, University of Denver, November 1988.

Goldman, A., F.J. Murcray, R.D. Blatherwick, J.J. Kusters, F.H. Murcray, D.G. Murcray and C.P. Rinsland, "New Spectral Features of Stratospheric Trace Gases Identified from High Resolution Infrared Balloon-borne and Laboratory Spectra," submitted to J. Geophys. Res., January 1989.

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